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A COMPARISON BETWEEN THE UPTAKES OF RADIOACTIVE PERCHLORATE AND IODIDE BY RAT AND GUINEA-PIG THYROID GLANDS

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SUMMARY

Previous studies indicated that ^{36}Cl-labelled perchlorate is concentrated by rat and rabbit thyroid gland. However, the extent of concentration of radioactive perchlorate in the gland was much less than that of iodide. Since perchlorate itself has a marked effect on anion transport in the thyroid and the specific activity of available [^{36}Cl]perchlorate is very low, the stable anion as a carrier present in the injected radioactive perchlorate solution may affect the uptake of this radioactive compound by the gland. In this study, radioactive solutions of perchlorate and iodide containing different amounts of stable perchlorate or iodide (dosages ranged from 0·005 to 5 m-equiv./kg. body weight) were injected into groups of rats and guinea-pigs, and the thyroid : plasma concentration ratios of radioactive perchlorate and iodide were calculated and compared. These experiments were also repeated in animals pretreated with thyroid-stimulating hormone (TSH), after chronic administration of propylthiouracil (PTU), as well as in hypophysectomized animals. At the same dose levels of perchlorate, there was no difference in thyroid : plasma concentration ratios of radioactive perchlorate and iodide in control rats and guinea-pigs or in treated ones.

INTRODUCTION

Besides iodide, many other monovalent anions such as bromide (Br^-), astatide (At^-), perrhenate (ReO_4^-), pertechnetate (TcO_4^-), perchlorate (ClO_4^-) and others are concentrated by the thyroid gland (Baumann, Searle, Yalow, Siegel & Seidlin, 1956; Durbin, Hamilton & Parrott, 1956; Shellabarger, 1956; Anbar, Guttmann & Lewitus, 1959; Chow & Woodbury, 1965; Papadopoulos, MacFarlane & Harden, 1967*a*, *b*). However, the extent of their concentration in the thyroid gland varies considerably. In most cases, the magnitude of accumulation of these monovalent anions in the thyroid gland is much smaller than that of iodide. Changes in the functional state of the thyroid usually affect the uptake of these substances by the

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gland. For example, pretreatment with thiouracil-like compounds or thyroid-stimulating hormone (TSH) usually increases their accumulation in the thyroid (Durbin *et al.* 1956; Shellabarger, 1956; Papadopoulos *et al.* 1967*b*; Lewitus, Guttmann & Anbar, 1962).

Previous studies have indicated that ^{36}Cl-labelled perchlorate is accumulated in rat and rabbit thyroid (Anbar *et al.* 1959; Chow & Woodbury, 1965 and unpublished observations). However, the thyroid : plasma ratio of perchlorate radioactivity is much less than that of iodide. Since perchlorate is the most potent known inhibitor of thyroidal iodide transport (Wyngaarden, Wright & Ways, 1952) and the specific activity of available [^{36}Cl]perchlorate is very low, the stable perchlorate ion present as a carrier in the injected radioactive solution probably saturates the transport system, and thus, in turn, may exert a marked effect on the uptake of this radioactive compound by the gland. The purpose of this study was to investigate the influence of carrier, and/or simultaneous administration of various amounts of stable perchlorate or iodide on the uptakes of [^{36}Cl]perchlorate and [^{131}I]iodide by the rat and guinea-pig thyroid glands. In order to assess the effect of the functional state of the thyroid on the uptakes of these anions, some experiments were also repeated on hypophysectomized animals, as well as on others pretreated with TSH or with propylthiouracil (PTU) for a protracted period.

MATERIALS AND METHODS

Male Sprague–Dawley rats and albino guinea-pigs of about 200 g. body weight were used. Rats were maintained on the chicken food of the Taiwan Sugar Corporation (protein > 20 %, fat > 3 %, total iodide about 0·003 %) and water *ad libitum*. Guinea-pigs were maintained on sweet potato, bran, fresh vegetables and water. Hypophysectomy was done by the parapharyngeal approach under ether anaesthesia. Operated animals were maintained on a soft diet including sweet potatoes, oranges, milk and bread for 2 weeks. Completeness of hypophysectomy was checked at autopsy by examination of the sellar region. For chronic treatment with PTU, the drug was added to the drinking water in a final concentration of 0·1 % for 2 weeks. For pretreatment with TSH, 1 i.u. TSH in 0·9 % NaCl solution was injected i.p. into rats 18 hr. and into guinea-pigs 24 hr. before the experiment.

Radioactive perchlorate or iodide solution was administered i.p. 2 hr. before the animals were killed. In the animals injected with radioactive iodide, PTU in a dose of 20 mg./animal was given s.c. 45 min. before the injection of radioactive iodide in order to block the synthesis of organic iodo-compounds in the thyroid. Solutions of radioactive perchlorate and iodide containing different amounts of stable perchlorate or iodide were prepared by diluting the stock radioactive solutions and adding adequate amounts of stable salt to make the final solution for injection.

^{36}Cl-labelled potassium perchlorate with a specific activity of 25·2 μc/m-mole was obtained from the Volk Company, Illinois, U.S.A. and carrier-free Na^{131}I from the Institute of Nuclear Science, National Tsing Hwa University, Taiwan. Thyroid-stimulating hormone (NIH-TSH-B-2, bovine, 4 i.u./mg.) was obtained from the Endocrinology Study Section of the National Institutes of Health, USPHS.

At the scheduled time after the injection of the radioactive solution, the animals were anaesthetized, rats by inhalation of ether and guinea-pigs with pentobarbitone sodium, 35 mg./kg.,
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Table 1. *Body weigl*
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Intact, chronic PTU
Intact, TSH
Hypox, control
Hypox, TSH

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sodium, 35 mg./kg., i.p. Five ml. blood were taken from the descending aorta with a heparinized syringe. The plasma was used for radioactivity determination. After the blood was taken, the large blood vessels in the abdomen were cut in order to remove as much as possible of the remaining blood from the animal. The thyroid gland was then removed and freed from surrounding tissues and weighed immediately on a Mettler M 5 microbalance. A small piece of gluteal muscle was also taken from the same animals. All tissues were digested with adequate amount of 1 M-piperidine solution. Both plasma and tissues were counted in a Tracerlab Multimatic planchet counting system. The tissue:plasma radioactivity ratios were then calculated according to the following formula:

$$\frac{\text{Tissue}}{\text{Plasma}} = \frac{\text{Tissue activity (counts/min./g.)}}{\text{Plasma activity (counts/min./ml.)}} \times \text{self absorption factor.}$$

Table 1. *Body weight, thyroid weight, and thyroid:plasma (T:P) and muscle:plasma (M:P) concentration ratios of [^{36}Cl]perchlorate in intact and hypophysectomized rats (Means* ± S.E.)

State of animals	Dose of stable ClO_4^- (m-equiv./kg.)	T:P $^{36}ClO_4^-$	M:P $^{36}ClO_4^-$	Thyroid wt. (mg.)	Body wt. (g.)
Intact, control	0·1	1·52 ± 0·18	0·134 ± 0·002	8·4 ± 0·42	196 ± 2·4
	0·2	0·92 ± 0·11	0·161 ± 0·004	8·9 ± 0·37	199 ± 5·6
	5·0	0·37 ± 0·04	0·135 ± 0·004	8·2 ± 0·34	215 ± 3·8
Intact, chronic PTU	0·1	2·72 ± 0·56 NS*	0·157 ± 0·002 < 0·001	26·3 ± 1·40 < 0·001	174 ± 3·2 < 0·005
Intact, TSH	0·2	1·31 ± 0·19 NS	0·114 ± 0·010 < 0·001	9·5 ± 0·60 NS	206 ± 2·8 NS
Hypox, control	0·1	0·39 ± 0·02 < 0·001	0·120 ± 0·010 < 0·001	6·9 ± 0·20 < 0·025	168 ± 2·2 < 0·001
	5·0	0·35 ± 0·03 NS	0·132 ± 0·011 NS	6·7 ± 0·20 < 0·01	162 ± 1·8 < 0·001
Hypox, TSH	0·1	0·67 ± 0·06 (< 0·01)†	0·150 ± 0·010 (< 0·001)	7·2 ± 0·22 (NS)	158 ± 2·1 (< 0·025)

In this and subsequent tables, each group consisted of 5–8 animals. NS = $P > 0·05$.
*P value when compared with the intact control animals at the same dose level.
†P value when compared with the hypophysectomized control animals at the same dose level.

RESULTS

Effect of hypophysectomy and pretreatment with TSH or prolonged PTU on the uptake of radioactive perchlorate by the rat thyroid

Forty-five male rats were divided into eight groups: five intact and three hypophysectomized groups. Of the five intact groups, three were controls, one was pretreated with TSH, and one was pretreated with PTU. Of the three hypophysectomized groups, two were controls, and one was pretreated with TSH. The body weight of the animals, thyroid weight and corresponding thyroid:plasma and muscle:plasma concentration of [^{36}Cl]perchlorate activity are shown in Table 1. Perchlorate in doses of 0·1 to 0·2 m-equiv./kg. was concentrated by the thyroid glands of the intact controls, and rats pretreated with TSH or after prolonged PTU treatment, but not by the thyroids of the hypophysectomized rats. In the intact controls, uptakes of [^{36}Cl]per-

chlorate were much higher in animals receiving smaller doses of stable perchlorate. When the doses of stable perchlorate reached 5 m-equiv./kg., the thyroid:plasma ratio of [^{36}Cl]perchlorate in the intact controls was the same as that in the hypophysectomized rats. Pretreatment with TSH caused an increase in thyroid:plasma ratio of radioactive perchlorate in hypophysectomized animals. Uptake of [^{36}Cl]-perchlorate by the skeletal muscle was much less than that of the thyroid gland (Table 1).

Effect of stable perchlorate and iodide on the uptake of radioactive perchlorate or iodide by the thyroid gland in rats and guinea-pigs

A total of 210 male rats and 195 male guinea-pigs were used in these experiments. The effect of stable perchlorate on the uptake of radioactive perchlorate, and the effect of stable perchlorate and iodide on the uptake of radioactive iodide, were studied separately in control and TSH-pretreated rats. Body weight and thyroid

Table 2. *Body weight, thyroid weight, and thyroid:plasma (T:P) and muscle:plasma (M:P) concentration ratios of $^{36}ClO_4^-$ in rats and guinea-pigs receiving the stable and radioactive perchlorate solution (Means ± S.E.)*

State of animals	Dose of stable ClO_4^- (m-equiv./kg.)	T:P $^{36}ClO_4^-$	M:P $^{36}ClO_4^-$	Thyroid wt. (mg.)	Body wt. (g.)
Rat, control	0·005	31·1 ± 3·25	0·140 ± 0·017	10·2 ± 0·93	161 ± 12·8
	0·01	16·0 ± 1·96 (< 0·02)†	0·157 ± 0·007	7·9 ± 1·02	162 ± 6·8
	0·02	8·0 ± 1·53 (< 0·05)	0·147 ± 0·010	7·9 ± 0·91	151 ± 7·8
	0·05	3·4 ± 0·52 (< 0·05)	0·112 ± 0·011	8·1 ± 0·38	158 ± 10·9
	0·10	2·5 ± 0·33 (NS)	0·093 ± 0·002	9·7 ± 1·28	157 ± 8·9
TSH-pretreated	0·005	37·2 ± 4·89 NS*	0·082 ± 0·004 < 0·01	15·9 ± 2·19 NS	155 ± 10·9 NS
	0·01	32·7 ± 3·35 (NS) < 0·005	0·082 ± 0·003 < 0·001	12·1 ± 1·44 NS	146 ± 9·5 NS
	0·02	16·3 ± 1·12 (< 0·01) < 0·005	0·085 ± 0·002 < 0·001	11·6 ± 0·93 < 0·05	151 ± 8·4 NS
	0·05	6·6 ± 0·32 (< 0·001) < 0·005	0·083 ± 0·002 < 0·05	12·1 ± 1·46 < 0·05	166 ± 15·4 NS
	0·10	4·5 ± 0·34 (< 0·01) < 0·005	0·086 ± 0·002 NS	13·1 ± 1·41 NS	158 ± 15·6 NS
Guinea-pig, control	0·005	122·8 ± 21·0	0·163 ± 0·004	20·5 ± 1·32	221 ± 8·7
	0·01	67·5 ± 9·4 (NS)	0·155 ± 0·002	18·2 ± 1·61	234 ± 8·4
	0·02	31·0 ± 5·4 (< 0·02)	0·160 ± 0·008	24·4 ± 3·12	218 ± 14·6
	0·05	13·6 ± 1·3 (< 0·05)	0·122 ± 0·006	23·0 ± 1·12	210 ± 9·6
	0·10	8·3 ± 0·9 (< 0·02)	0·110 ± 0·007	21·5 ± 1·90	211 ± 19·1
TSH-pretreated	0·005	161·9 ± 28·4 NS	0·140 ± 0·001 NS	23·4 ± 3·06 NS	199 ± 11·2 NS
	0·01	102·4 ± 17·3 NS	0·133 ± 0·002 NS	22·1 ± 2·44 NS	208 ± 10·5 NS
	0·02	56·5 ± 8·6 (NS) < 0·05	0·135 ± 0·002 NS	21·8 ± 2·21 NS	195 ± 13·6 NS
	0·05	33·6 ± 7·2 (< 0·05) < 0·001	0·107 ± 0·002 NS	25·0 ± 2·86 NS	206 ± 12·4 NS
	0·10	26·2 ± 3·3 (NS) < 0·01	0·106 ± 0·005 NS	26·9 ± 1·90 NS	193 ± 8·8 NS

* *P* value when compared with the control animals at the same dose level.
† *P* value when compared with the preceding smaller dose of the same group (control or TSH-pretreated).

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Table 3. *Body weight, th*
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and radioactive iodide so

State of animals	Dose of stable ClO (m-equiv., kg.)
Rat, control	0·005
	0·01
	0·02
	0·05
	0·10
TSH-pretreated	0·005
	0·01
	0·02
	0·05
	0·10
Guinea-pig, control	0·005
	0·01
	0·02
	0·05
	0·10
TSH-pretreated	0·005
	0·01
	0·02
	0·05
	0·10

*P value when compared wi
†P value when compared w
treated).

weight, and the uptakes of radioactive compounds by the thyroid gland and skeletal muscle are shown in Tables 2–4. Both iodide and perchlorate ions were concentrated in rat thyroid but not in skeletal muscle. The extent of concentration of radioactive anions in the thyroid gland was closely related to the doses of stable perchlorate or iodide received. As the doses of stable perchlorate or iodide increased, the thyroid uptakes of these radioactive compounds decreased. At the same dose levels of perchlorate, there was no difference between the thyroid:plasma concentration ratio of radioactive perchlorate and that of iodide. However, as expected, the inhibitory effect of perchlorate on the uptakes of radioactive monovalent anions was greater than that of iodide. In the experiment testing the effect of stable perchlorate on [^{36}Cl]perchlorate uptake, TSH-pretreated rats had higher thyroid:plasma concentration ratios than the controls (Table 2). However, in the other two experiments, pretreatment with TSH did not significantly affect the thyroid:plasma concentration ratios of radioactive iodide (Tables 3 and 4).

Table 3. *Body weight, thyroid weight, and thyroid:plasma (T:P) and muscle:plasma (M:P) concentration ratios of $^{131}I^-$ in rats and guinea-pigs receiving the stable perchlorate and radioactive iodide solution (Means ± S.E.)*

State of animals	Dose of stable ClO_4^- (m-equiv./kg.)	T:P $^{131}I^-$	M:P $^{131}I^-$	Thyroid wt. (mg.)	Body wt. (g.)
Rat, control	0·005	31·8 ± 3·00	0·093 ± 0·001	14·4 ± 0·88	209 ± 4·6
	0·01	14·3 ± 0·74 (< 0·01)†	0·091 ± 0·004	14·7 ± 1·13	218 ± 5·9
	0·02	9·3 ± 0·22 (< 0·001)	0·089 ± 0·002	17·0 ± 0·96	224 ± 7·0
	0·05	3·1 ± 0·98 (< 0·001)	0·089 ± 0·002	14·1 ± 0·93	209 ± 5·2
	0·10	3·0 ± 0·12 (NS)	0·094 ± 0·002	13·0 ± 0·48	215 ± 5·6
TSH-pretreated	0·005	23·1 ± 1·6 < 0·05*	0·079 ± 0·002 < 0·001	16·9 ± 1·82 NS	251 ± 9·5 < 0·01
	0·01	10·5 ± 1·21 (< 0·001) < 0·05	0·078 ± 0·001 < 0·05	16·2 ± 0·96 NS	251 ± 11·9 < 0·05
	0·02	7·7 ± 0·91 (NS) NS	0·083 ± 0·001 NS	17·6 ± 1·00 NS	263 ± 10·0 < 0·02
	0·05	3·7 ± 0·45 (< 0·001) NS	0·080 ± 0·002 < 0·05	15·6 ± 0·95 NS	251 ± 12·3 < 0·02
	0·10	3·2 ± 0·12 (NS) NS	0·079 ± 0·002 < 0·01	15·4 ± 0·97 NS	247 ± 10·2 < 0·02
Guinea-pig, control	0·005	100·4 ± 20·2	0·109 ± 0·005	26·5 ± 0·49	244 ± 8·0
	0·01	79·0 ± 16·4 (NS)	0·117 ± 0·006	22·9 ± 1·40	239 ± 10·0
	0·02	32·5 ± 2·4 (< 0·05)	0·105 ± 0·003	23·3 ± 1·28	244 ± 8·1
	0·05	12·7 ± 1·2 (< 0·01)	0·108 ± 0·007	27·9 ± 1·41	248 ± 9·8
	0·10	8·9 ± 1·2 (NS)	0·119 ± 0·003	25·5 ± 1·90	233 ± 7·6
TSH-pretreated	0·005	167·4 ± 16·2 NS	0·154 ± 0·009 < 0·01	30·7 ± 4·40 NS	188 ± 2·6 < 0·01
	0·01	92·3 ± 18·2 (< 0·05) NS	0·124 ± 0·006 NS	34·2 ± 1·77 < 0·01	192 ± 9·8 < 0·05
	0·02	57·1 ± 10·8 (NS) NS	0·139 ± 0·007 < 0·02	32·6 ± 4·71 NS	182 ± 4·9 < 0·001
	0·05	46·1 ± 6·1 (NS) < 0·01	0·111 ± 0·009 NS	31·1 ± 2·58 NS	188 ± 5·2 < 0·05
	0·10	17·6 ± 2·9 (< 0·02) < 0·05	0·115 ± 0·009 NS	32·5 ± 5·36 NS	183 ± 5·4 < 0·01

*P value when compared with the control animals at the same dose level.

†P value when compared with the preceding smaller dose of the same group (control or TSH-pretreated).

The effect of stable perchlorate on the thyroidal uptake of radioactive perchlorate and the effect of stable perchlorate and iodide on the uptake of radioactive iodide were also studied in control guinea-pigs and TSH-pretreated ones. The tissue uptakes of radioactive compounds are also shown in Tables 2–4. Like the rat thyroid, guinea-pig thyroid also accumulated both iodide and perchlorate ions, and the extent of accumulation of radioactive anions in the thyroid gland was also closely related to the doses of stable anions injected. However, the guinea-pig thyroid accumulated more radioactive iodide and perchlorate than the rat thyroid, and the effect of pretreatment with TSH on the uptake of monovalent anions was also more prominent in guinea-pig experiments.

Table 4. *Body weight, thyroid weight, and thyroid : plasma (T : P) and muscle : plasma (M : P) concentration ratios of $^{131}I^-$ in rats and guinea-pigs receiving the stable and radioactive iodide solution (Means ± S.E.)*

State of animals	Dose of stable I⁻ (m-equiv./kg.)	T:P $^{131}I^-$	M:P $^{131}I^-$	Thyroid wt. (mg.)	Body wt. (g.)
Rat, control	0·005	94·6 ± 12·0	0·091 ± 0·001	11·3 ± 0·57	212 ± 7·2
	0·01	89·2 ± 8·7 (NS)†	0·085 ± 0·001	10·3 ± 0·52	203 ± 5·7
	0·02	77·0 ± 8·5 (NS)	0·081 ± 0·001	8·7 ± 0·53	193 ± 2·1
	0·05	38·8 ± 2·3 (< 0·01)	0·088 ± 0·005	9·8 ± 0·91	206 ± 7·9
	0·10	26·3 ± 2·9 (< 0·02)	0·091 ± 0·004	10·3 ± 0·47	203 ± 4·0
TSH-pretreated	0·005	80·9 ± 12·0 NS*	0·086 ± 0·002 NS	10·0 ± 0·59 NS	213 ± 6·2 NS
	0·01	90·7 ± 25·5 (NS) NS	0·081 ± 0·004 NS	9·2 ± 0·56 NS	207 ± 5·7 NS
	0·02	79·8 ± 15·0 (NS) NS	0·090 ± 0·002 < 0·05	10·6 ± 1·00 NS	212 ± 5·8 < 0·05
	0·05	31·5 ± 2·5 (< 0·05) NS	0·082 ± 0·004 NS	9·9 ± 0·76 NS	206 ± 6·9 NS
	0·10	29·3 ± 4·3 (NS) NS	0·083 ± 0·004 NS	10·9 ± 0·88 NS	202 ± 7·5 NS
Guinea-pig, control	0·005	273·7 ± 27·6	0·151 ± 0·011	20·7 ± 0·84	242 ± 3·1
	0·01	190·3 ± 15·6 (NS)	0·147 ± 0·008	21·7 ± 0·96	240 ± 4·8
	0·02	197 ± 25·2 (NS)	0·137 ± 0·004	15·6 ± 0·86	237 ± 4·0
	0·05	139 ± 25·1 (NS)	0·140 ± 0·003	18·9 ± 1·48	242 ± 6·7
	0·10	66·1 ± 11·9 (NS)	0·123 ± 0·007	22·5 ± 0·94	237 ± 5·4
TSH-pretreated	0·005	311·6 ± 15·2 NS	0·080 ± 0·005 < 0·01	34·5 ± 4·73 < 0·05	227 ± 10·9 NS
	0·01	307·3 ± 42·7 (NS) NS	0·093 ± 0·004 < 0·01	25·6 ± 1·58 NS	231 ± 10·8 NS
	0·02	223·2 ± 45·9 (NS) NS	0·093 ± 0·005 < 0·01	28·8 ± 1·84 < 0·001	266 ± 11·4 NS
	0·05	150·7 ± 28·3 (NS) NS	0·101 ± 0·002 < 0·01	27·9 ± 2·38 < 0·05	230 ± 8·5 NS
	0·10	81·0 ± 11·0 (NS) NS	0·105 ± 0·005 NS	26·9 ± 1·33 < 0·05	226 ± 7·7 NS

*P value when compared with the control animals at the same dose level.
†P value when compared with the preceding smaller dose of the same group (control or TSH-pretreated).

Uptake of [^{36}Cl]perchlorate and Na^{131}I by the skeletal muscle was much less than that by the thyroid gland, and was not affected by the different doses of the injected anions in both the rat and the guinea-pig.

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DISCUSSION

Anbar *et al.* (1959) were the first to report the uptake of radioactive perchlorate by the thyroid. They found that radioactive perchlorate was concentrated to some extent in the thyroid glands of rat and rabbit. They also found that the uptake of perchlorate by the thyroid gland was enhanced after treatment with TSH (Lewitus *et al.* 1962). These and our previous studies (Chow & Woodbury, 1965 and unpublished observations) demonstrated that radioactive perchlorate was concentrated by the thyroid glands of the rat, guinea-pig, cockerel and dog, and that the extent of accumulation in the thyroid gland was closely related to the blood concentration of TSH.

Although the thyroid gland accumulates iodide as well as many other monovalent anions, there are known to be certain differences between the anions. The most striking difference is found in the magnitude of the concentration of these radioactive substances in thyroid gland in that iodide is favoured even when the organic binding of radioactive iodide had been blocked. The transport system in the thyroid is probably the same for all anions that are concentrated by the gland. The effect of anions on the accumulation of iodide by the thyroid gland has long been known (Wyngaarden *et al.* 1952) and the effect of stable iodide and perchlorate on the radioactive iodide uptake by the thyroid has been reported by many authors (Wyngaarden, Stanbury & Rapp, 1953; Halmi, Stuelke & Schnell, 1956; Halmi, Granner, Müller, Peters & Smith, 1960; Hart, Druet, Bauer & Mack, 1961; Slingerland, 1963; Scranton & Halmi, 1965; Schönbaum, Sellers & Gill, 1965). These two anions are apparently competitive antagonists as indicated by the results shown in Tables 2–4. Therefore, the magnitude of thyroidal uptake of either of these anions depends on the total amount of anion(s) injected, including both the radioactive and the stable forms.

The specific activity of available [^{36}Cl]perchlorate was 25·2 μc/m-mole. When 0·5 to 1 μc of this radioactive compound was injected into animals of 200 g. body weight, each animal received 0·1 to 0·2 m-equiv. of perchlorate ion/kg. Such doses of perchlorate have some depressive effect on the thyroidal transport system. Thus, the uptake of radioactive perchlorate by the thyroid glands of the rat, rabbit and guinea-pig found in previous studies were much smaller than those of radioactive iodide. In this study, when the concentration of perchlorate was reduced to 0·005 m-equiv./kg., the thyroid:plasma ratio for radioactive perchlorate was more than ten times greater than when 0·1 m-equiv./kg. was given (Table 2). When the same amounts (0·005–0·1 m-equiv./kg.) of stable perchlorate were added to the carrier-free radioactive iodide solutions, the thyroidal uptake of radioactive iodide decreased to the same magnitude as that of radioactive perchlorate (Tables 2 and 3).

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